SNx4LV240A Octal Inverting Buffers/Drivers With 3-State Outputs

1 Features

- 2-V to 5.5-V V_{CC} Operation
- Max t_{pd} of 6.5 ns at 5 V
- Typical V_{OLP} (Output Ground Bounce) <0.8 V at V_{CC} = 3.3 V, T_A = 25°C
- Typical V_{OHV} (Output V_{OH} Undershoot) >2.3 V at V_{CC} = 3.3 V, T_A = 25°C
- Support Mixed-Mode Voltage Operation on All Ports
- Latch-Up Performance Exceeds 250 mA per JESD 17
- I_{off} Supports Live Insertion, Partial Power-Down Mode, and Back Drive Protection
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

2 Applications

- Handset: Smartphone
- Network Switch
- Health and Fitness / Wearables

3 Description

These octal buffers/drivers with inverted outputs are designed for 2-V to 5.5-V V_{CC} operation.

The 'LV240A devices are designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters.

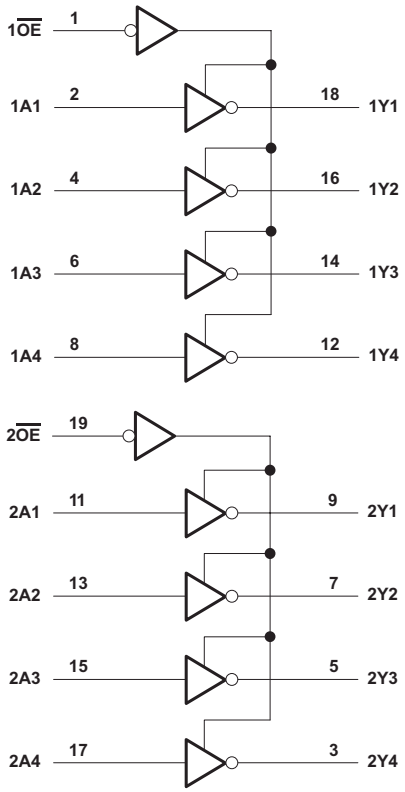
These devices are organized as two 4-bit buffers/line drivers with separate output-enable ($\overline{OE}$) inputs. When $\overline{OE}$ is low, the device passes inverted data from the A inputs to the Y outputs. When $\overline{OE}$ is high, the outputs are in the high-impedance state.

Device Information(1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
LV240A	TVSOP (14)	3.60 mm × 4.40 mm
	SOIC (14)	8.65 mm × 3.91 mm
	SOP (14)	10.30 mm × 5.30 mm
	SSOP (14)	6.20 mm × 5.30 mm
	TSSOP (14)	5.00 mm × 4.40 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

4 Logic Diagram (Positive Logic)



An IMPORTANT NOTICE at the end of this data sheet addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers. PRODUCTION DATA.

Table of Contents

5 Revision History

Changes from Revision H (April 2005) to Revision I **Page**

- Added *ESD Ratings* table, *Feature Description* section, *Device Functional Modes*, *Application and Implementation* section, *Power Supply Recommendations* section, *Layout* section, *Device and Documentation Support* section, and *Mechanical, Packaging, and Orderable Information* section ... 1
- Updated operating free-air temperature maximum from 85°C to 125°C for SN74LV240A ... 5

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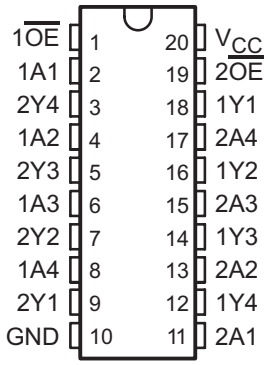
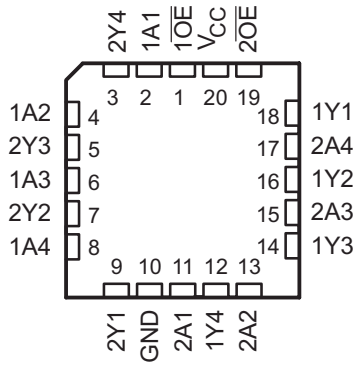
6 Pin Configuration and Functions

SN54LV240A: J or W Package
SN74LV240A: DB, DGV, DW, NS, or PW Package
(Top View)



SN54LV240A: FK Package
(Top View)



Pin Functions

PIN	I/O	DESCRIPTION
1	1OE	Output enable 1
2	1A1	1A1 input
3	2Y4	2Y4 output
4	1A2	1A2 input
5	2Y3	2Y3 output
6	1A3	1A3 input
7	2Y2	2Y2 output
8	1A4	1A4 input
9	2Y1	2Y1 output
10	GND	Ground pin
11	2A1	2A1 input
12	1Y4	1Y4 output
13	2A2	2A2 input
14	1Y3	1Y3 output
15	2A3	2A3 input
16	1Y2	1Y2 output
17	2A4	2A4 input
18	1Y1	1Y1 output
19	2OE	Output enable 2
20	VCC	Power pin

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7 Specifications

7.1 Absolute Maximum Ratings(1)

over operating free-air temperature (unless otherwise noted)

			MIN	MAX	UNIT
V_{CC}	Supply voltage		–0.5	7	V
V_I	Input voltage(2)		–0.5	7	V
V_O	Voltage applied to any output in the high-impedance or power-off state(2)		–0.5	7	V
V_O	Output voltage(2) (3)		–0.5	V_{CC} + 0.5	V
I_{IK}	Input clamp current	V_I < 0		–20	mA
I_{OK}	Output clamp current	V_O < 0		–50	mA
I_O	Continuous output current	V_O = 0 to V_{CC}	–35	35	mA
	Continuous current through V_{CC} or GND		–70	70	mA
T_{stg}	Storage temperature		–65	150	°C

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
(3) The value is limited to 5.5-V maximum.

7.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001(1)	±2000	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101(2)	±1000	
		Machine model (A115-A)	200	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

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7.3 Recommended Operating Conditions

see (1)

			MIN	MAX	UNIT
V_{CC}	Supply voltage		2	5.5	V
V_{IH}	High-level input voltage	V_{CC} = 2 V	1.5		V
		V_{CC} = 2.3 to 2.7 V	V_{CC} × 0.7		
		V_{CC} = 3 to 3.6 V	V_{CC} × 0.7		
		V_{CC} = 4.5 to 5.5 V	V_{CC} × 0.7		
V_{IL}	Low-level input voltage	V_{CC} = 2 V		0.5	V
		V_{CC} = 2.3 to 2.7 V		V_{CC} × 0.3	
		V_{CC} = 3 to 3.6 V		V_{CC} × 0.3	
		V_{CC} = 4.5 to 5.5 V		V_{CC} × 0.3	
V_I	Input voltage		0	5.5	V
V_O	Output voltage	High or low state	0	V_{CC}	V
		3-state	0	5.5	
I_{OH}	High-level output current	V_{CC} = 2 V		–50	µA
		V_{CC} = 2.3 to 2.7 V		–2	mA
		V_{CC} = 3 to 3.6 V		–8	
		V_{CC} = 4.5 to 5.5 V		–16	
I_{OL}	Low-level output current	V_{CC} = 2 V		50	µA
		V_{CC} = 2.3 to 2.7 V		2	mA
		V_{CC} = 3 to 3.6 V		8	
		V_{CC} = 4.5 to 5.5 V		16	
Δt/Δv	Input transition rise or fall rate	V_{CC} = 2.3 to 2.7 V		200	ns/V
		V_{CC} = 3 to 3.6 V		100	
		V_{CC} = 4.5 to 5.5 V		20	
T_A	Operating free-air temperature	SN54LV240A	–55	125	°C
		SN74LV240A	–40	125	

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, SCBA004.

7.4 Thermal Information

THERMAL METRIC(1)		DW	DB	DGV	NS	PW	UNIT
		20 PINS					
$R_{\theta JA}$	Junction-to-ambient thermal resistance(2)	79.2	94.5	116.2	76.7	102.4	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	43.7	56.4	31.2	43.2	36.5	
$R_{\theta JB}$	Junction-to-board thermal resistance	47.0	49.7	57.7	44.2	53.6	
ψ_{JT}	Junction-to-top characterization parameter	18.6	18.5	0.9	16.8	2.4	
ψ_{JB}	Junction-to-board characterization parameter	46.5	49.3	57.0	43.8	52.9	

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, SPRA953.
(2) The package thermal impedance is calculated in accordance with JESD 51-7.

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7.5 Electrical Characteristics

over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	V_{CC}	MIN	TYP	MAX	UNIT
V_{OH}	I_{OH} = –50 µA	2 to 5.5 V	V_{CC} – 0.1			V
	I_{OH} = –2 mA	2.3 V	2			
	I_{OH} = –8 mA	3 V	2.48			
	I_{OH} = –16 mA	4.5 V	3.8			
V_{OL}	I_{OL} = 50 µA	2 to 5.5 V			0.1	V
	I_{OL} = 2 mA	2.3 V			0.4	
	I_{OL} = 8 mA	3 V			0.44	
	I_{OL} = 16 mA	4.5 V			0.55	
I_I	V_I = 5.5 V or GND	0 to 5.5 V			±1	µA
I_{OZ}	$V_O = V_{CC}$ or GND	5.5 V			±5	µA
I_{CC}	$V_I = V_{CC}$ or GND, I_O = 0	5.5 V			20	µA
I_{off}	V_I or V_O = 0 to 5.5 V	0			5	µA
C_i	$V_I = V_{CC}$ or GND	3.3 V		2.3		pF

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7.6 Switching Characteristics, V_{CC} = 2.5 V ±0.2 V

over recommended operating free-air temperature range (unless otherwise noted) (see)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			MIN	MAX	UNIT
				MIN	TYP	MAX			
t_{pd}	A	Y	C_L = 15 pF		6.3(1)	11.6(1)	1(2)	14(2)	ns
t_{en}	$\overline{OE}$				8.5(1)	14.6(1)	1(2)	17(2)	
t_{dis}	$\overline{OE}$				9.7(1)	14.1(1)	1(2)	16(2)	
t_{pd}	A	Y	C_L = 50 pF		8.2	14.4	1	17	ns
t_{en}	$\overline{OE}$				10.3	17.8	1	21	
t_{dis}	$\overline{OE}$				14.2	19.2	1	21	
$t_{sk(o)}$						2		2(3)	

(1) On products compliant to MIL-PRF-38535, this parameter is not production tested.
(2) This note applies to SN54LV240A only: On products compliant to MIL-PRF-38535, this parameter is not production tested.
(3) Value applies for SN74LV240A only

7.7 Switching Characteristics, V_{CC} = 3.3 V ±0.3 V

over recommended operating free-air temperature range (unless otherwise noted) (see)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			MIN	MAX	UNIT
				MIN	TYP	MAX			
t_{pd}	A	Y	C_L = 15 pF		4.6(1)	7.5(1)	1(2)	9(2)	ns
t_{en}	$\overline{OE}$				6.2(1)	10.6(1)	1(2)	12.5(2)	
t_{dis}	$\overline{OE}$				8.3(1)	12.5(1)	1(2)	13.5(2)	
t_{pd}	A	Y	C_L = 50 pF		5.9	11	1	12.5	ns
t_{en}	$\overline{OE}$				7.5	14.1	1	16	
t_{dis}	$\overline{OE}$				11.8	15	1	17	
$t_{sk(o)}$						1.5		1.5(3)	

(1) On products compliant to MIL-PRF-38535, this parameter is not production tested.
(2) This note applies to SN54LV240A only: On products compliant to MIL-PRF-38535, this parameter is not production tested.
(3) Value applies for SN74LV240A only

7.8 Switching Characteristics, V_{CC} = 5 V ±0.5 V

over recommended operating free-air temperature range (unless otherwise noted) (see)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			MIN	MAX	UNIT
				MIN	TYP	MAX			
t_{pd}	A	Y	C_L = 15 pF		3.4(1)	5.5(1)	1(2)	6.5(2)	ns
t_{en}	$\overline{OE}$				4.6(1)	7.3(1)	1(2)	8.5(2)	
t_{dis}	$\overline{OE}$				7.4(1)	12.2(1)	1(2)	13.5(2)	
t_{pd}	A	Y	C_L = 50 pF		4.4	7.5	1	8.5	ns
t_{en}	$\overline{OE}$				5.6	9.3	1	10.5	
t_{dis}	$\overline{OE}$				9.7	14.2	1	15.5	
$t_{sk(o)}$						1		1(3)	

(1) On products compliant to MIL-PRF-38535, this parameter is not production tested.
(2) This note applies to SN54LV240A only: On products compliant to MIL-PRF-38535, this parameter is not production tested.
(3) This values applies for SN74LV240A only

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7.9 Noise Characteristics for SN74LV240A

V_{CC} = 3.3 V, C_L = 50 pF, T_A = 25°C (see (1))

PARAMETER		MIN	TYP	MAX	UNIT
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}		0.56		V
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}		–0.49		
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}		2.82		
$V_{IH(D)}$	High-level dynamic input voltage	2.31			
$V_{IL(D)}$	Low-level dynamic input voltage			0.99	

(1) Characteristics are for surface-mount packages only.

7.10 Operating Characteristics

T_A = 25°C

PARAMETER		TEST CONDITIONS	V_{CC}	TYP	UNIT
C_{pd}	Power dissipation capacitance	C_L = 50 pF, f = 10 MHz	3.3 V	14	pF
			5 V	16.4	

7.11 Typical Characteristics

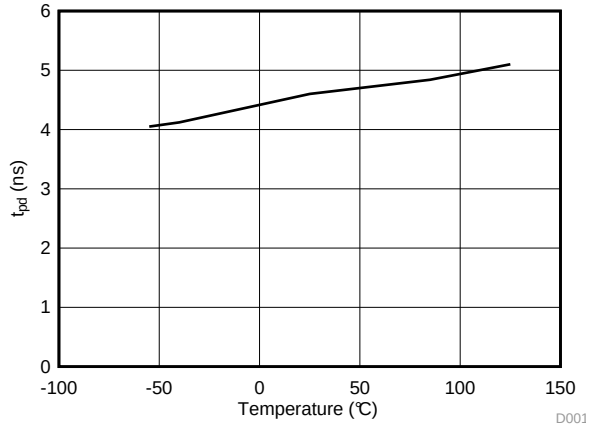

Figure 1. t_{pd} vs Temperature at 3.3-V V_{CC}

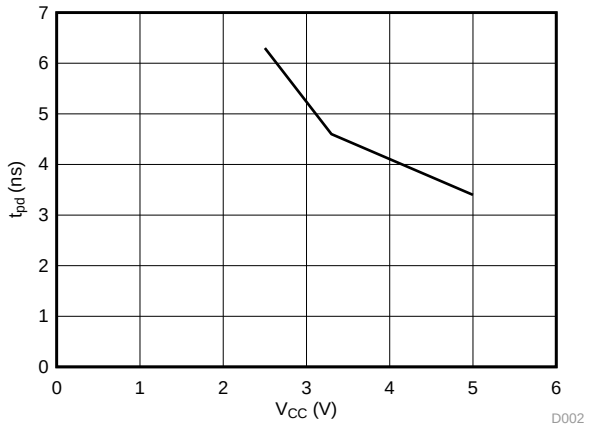

Figure 2. t_{pd} vs V_{CC} at 25°C

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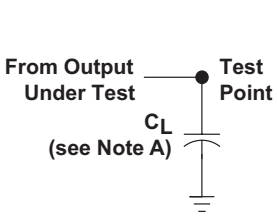
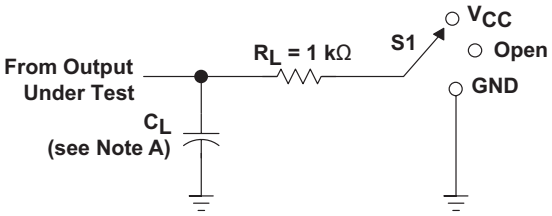
8 Parameter Measurement Information

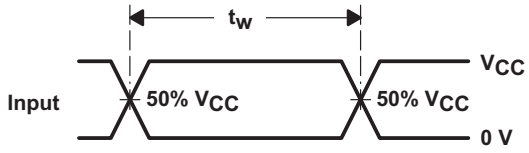


LOAD CIRCUIT FOR
TOTEM-POLE OUTPUTS

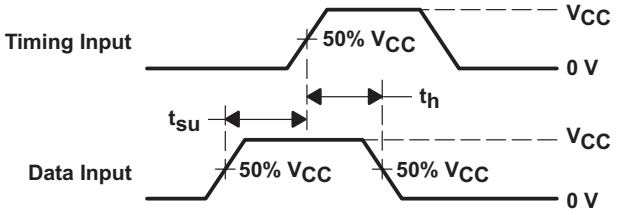


LOAD CIRCUIT FOR
3-STATE AND OPEN-DRAIN OUTPUTS

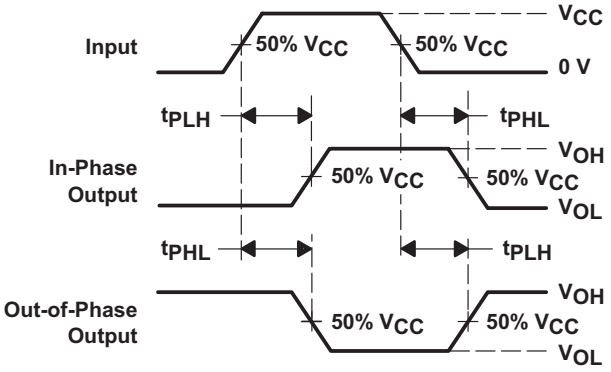
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{CC}
t_{PHZ}/t_{PZH}	GND
Open Drain	V_{CC}



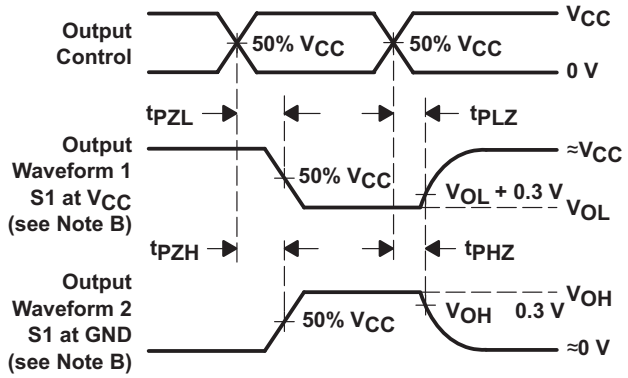
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

A. C_L includes probe and jig capacitance.

B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.

C. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z_O = 50 Ω, t_r ≤ 3 ns, t_f ≤ 3 ns.

D. The outputs are measured one at a time, with one input transition per measurement.

E. t_{PLZ} and t_{PHZ} are the same as t_{dis}.

F. t_{PZL} and tPZH are the same as t_{en}.

G. t_{PHL} and t_{PLH} are the same as t_{pd}.

H. All parameters and waveforms are not applicable to all devices.

Figure 3. Load Circuit and Voltage Waveforms

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9 Detailed Description

9.1 Overview

These octal buffers/drivers with inverted outputs are designed for 2-V to 5.5-V V_{CC} operation.

The ’LV240A devices are designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters.

These devices are organized as two 4-bit buffers/line drivers with separate output-enable ($\overline{OE}$) inputs. When $\overline{OE}$ is low, the device passes inverted data from the A inputs to the Y outputs. When $\overline{OE}$ is high, the outputs are in the high-impedance state.

9.2 Functional Block Diagram

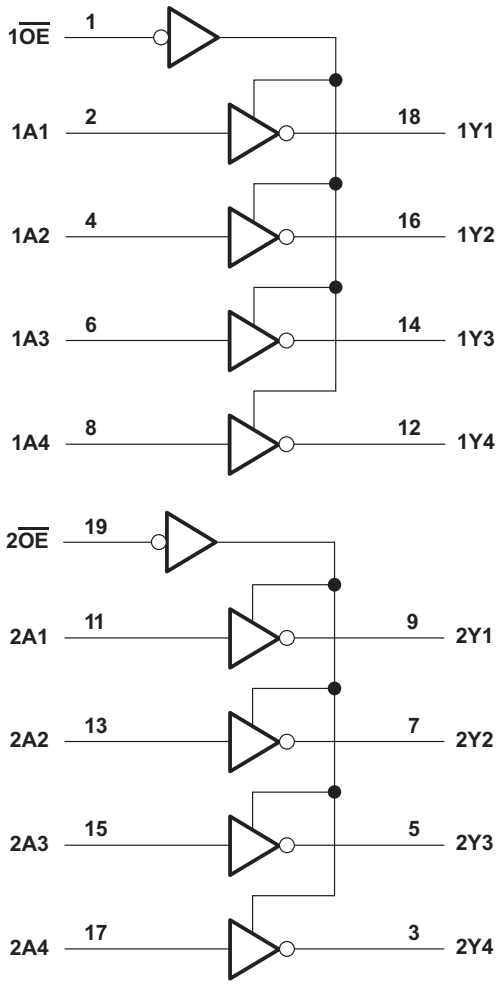

Figure 4. Logic Diagram (Positive Logic)

9.3 Feature Description

- Wide operating voltage range operates from 2-V to 5.5-V operation
- Allow down voltage translation inputs accept voltages to 5.5 V
- I_{off} feature allows voltages on the inputs and outputs when V_{CC} is 0 V

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9.4 Device Functional Modes

Table 1. Function Table (Each Buffer)

INPUTS		OUTPUT Y
$\overline{OE}$	A	
L	H	L
L	L	H
H	X	Z

10 Application and Implementation

NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

10.1 Application Information

The SN74LV240A is a low-drive CMOS device that can be used for a multitude of bus interface type applications where the data needs to be retained or latched. It can produce 8 mA of drive current at 3.3 V making it ideal for driving multiple outputs and low-noise applications. The inputs are 5.5-V tolerant allowing it to translate down to V_{CC}.

10.2 Typical Application

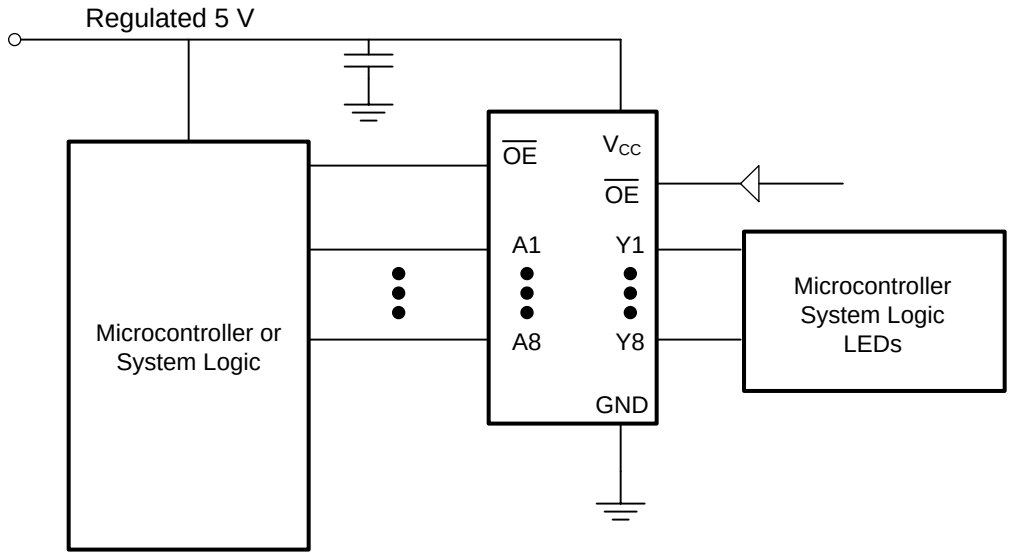

Figure 5. Typical Application Schematic

10.2.1 Design Requirements

This device uses CMOS technology and has balanced output drive. Care should be taken to avoid bus contention because it can drive currents that would exceed maximum limits. The high drive will also create fast edges into light loads so routing and load conditions should be considered to prevent ringing.

10.2.2 Detailed Design Procedure

1. Recommended input conditions
   - Rise time and fall time specifications see (Δt/ΔV) in *Recommended Operating Conditions*.
   - Specified high and low levels. See (V_{IH} and V_{IL}) in *Recommended Operating Conditions*.
   - Inputs are overvoltage tolerant allowing them to go as high as 5.5 V at any valid V_{CC}
2. Recommend output conditions
   - Load currents should not exceed 35 mA per output and 70 mA total for the part
   - Outputs should not be pulled above V_{CC}

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Typical Application (continued)

10.2.3 Application Curve

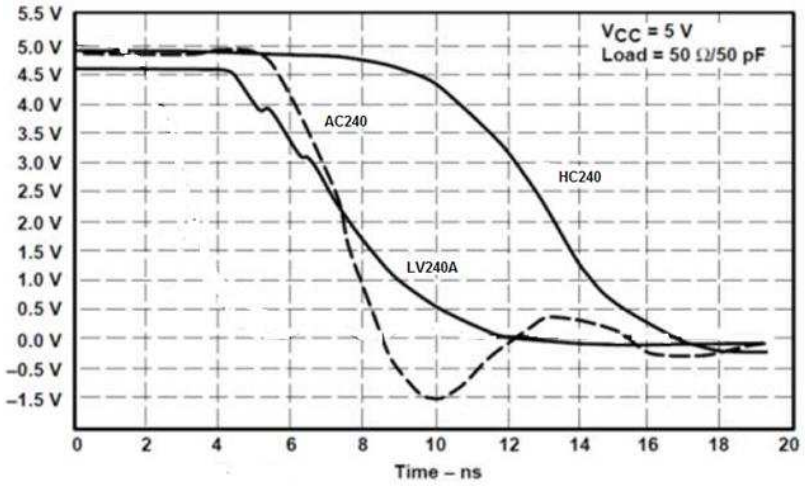

Figure 6. Switching Characteristics Comparison

11 Power Supply Recommendations

The power supply can be any voltage between the min and max supply voltage rating located in *Recommended Operating Conditions*.

Each V_{CC} terminal should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, TI recommends 0.1 µF and if there are multiple V_{CC} terminals, then TI recommends .01 µF or .022 µF for each power terminal. It is okay to parallel multiple bypass capacitors to reject different frequencies of noise. A 0.1 µF and 1 µF are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results.

12 Layout

12.1 Layout Guidelines

When using multiple bit logic devices inputs should not ever float.

In many cases, functions or parts of functions of digital logic devices are unused, for example, when only two inputs of a triple-input AND gate are used or only 3 of the 4 buffer gates are used. Such input pins should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. Specified below are the rules that must be observed under all circumstances. All unused inputs of digital logic devices must be connected to a high or low bias to prevent them from floating. The logic level that should be applied to any particular unused input depends on the function of the device. Generally they will be tied to GND or V_{CC} whichever make more sense or is more convenient. It is generally okay to float outputs unless the part is a transceiver. If the transceiver has an output enable pin it will disable the outputs section of the part when asserted. This does not disable the input section of the IOs so they cannot float when disabled.

12.2 Layout Example

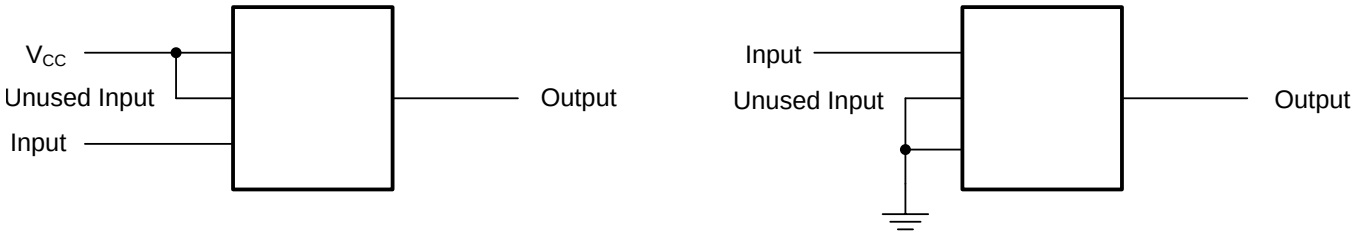

Figure 7. Layout Recommendation

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13 Device and Documentation Support

13.1 Related Links

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to sample or buy.

Table 2. Related Links

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
SN54LV240A	Click here	Click here	Click here	Click here	Click here
SN74LV240A	Click here	Click here	Click here	Click here	Click here

13.2 Trademarks

All trademarks are the property of their respective owners.

13.3 Electrostatic Discharge Caution

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

13.4 Glossary

SLYZ022 — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

14 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

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PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74LV240ADBR	ACTIVE	SSOP	DB	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV240A	Samples
SN74LV240ADBRE4	ACTIVE	SSOP	DB	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV240A	Samples
SN74LV240ADBRG4	ACTIVE	SSOP	DB	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV240A	Samples
SN74LV240ADGVR	ACTIVE	TVSOP	DGV	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV240A	Samples
SN74LV240ADW	ACTIVE	SOIC	DW	20	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV240A	Samples
SN74LV240ADWR	ACTIVE	SOIC	DW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV240A	Samples
SN74LV240ANSR	ACTIVE	SO	NS	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	74LV240A	Samples
SN74LV240APW	ACTIVE	TSSOP	PW	20	70	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV240A	Samples
SN74LV240APWG4	ACTIVE	TSSOP	PW	20	70	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV240A	Samples
SN74LV240APWR	ACTIVE	TSSOP	PW	20	2000	RoHS & Green	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	LV240A	Samples
SN74LV240APWRG4	ACTIVE	TSSOP	PW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV240A	Samples
SN74LV240APWT	ACTIVE	TSSOP	PW	20	250	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV240A	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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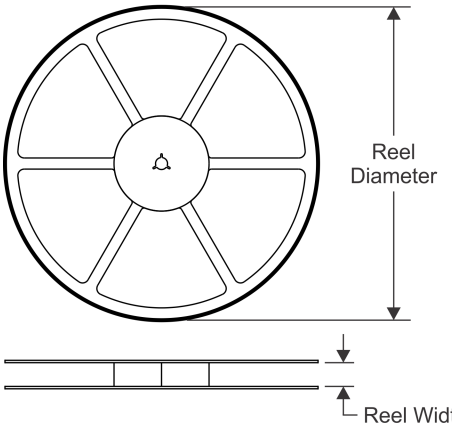
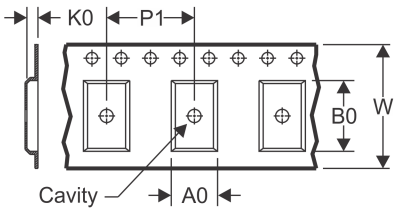
TAPE AND REEL INFORMATION

REEL DIMENSIONS

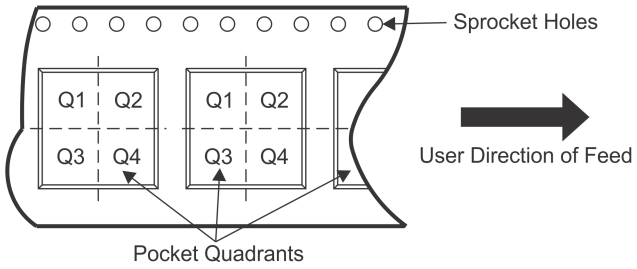


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

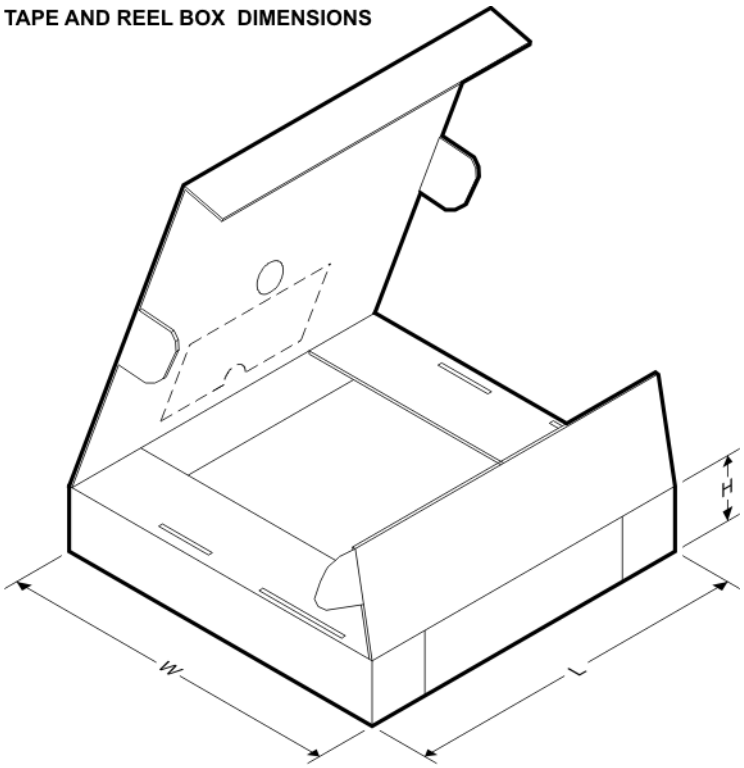
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LV240ADBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1
SN74LV240ADGVR	TVSOP	DGV	20	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LV240ADWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN74LV240ANSR	SO	NS	20	2000	330.0	24.4	8.4	13.0	2.5	12.0	24.0	Q1
SN74LV240APWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.0	1.4	8.0	16.0	Q1
SN74LV240APWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1
SN74LV240APWRG4	TSSOP	PW	20	2000	330.0	16.4	6.95	7.0	1.4	8.0	16.0	Q1
SN74LV240APWT	TSSOP	PW	20	250	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS

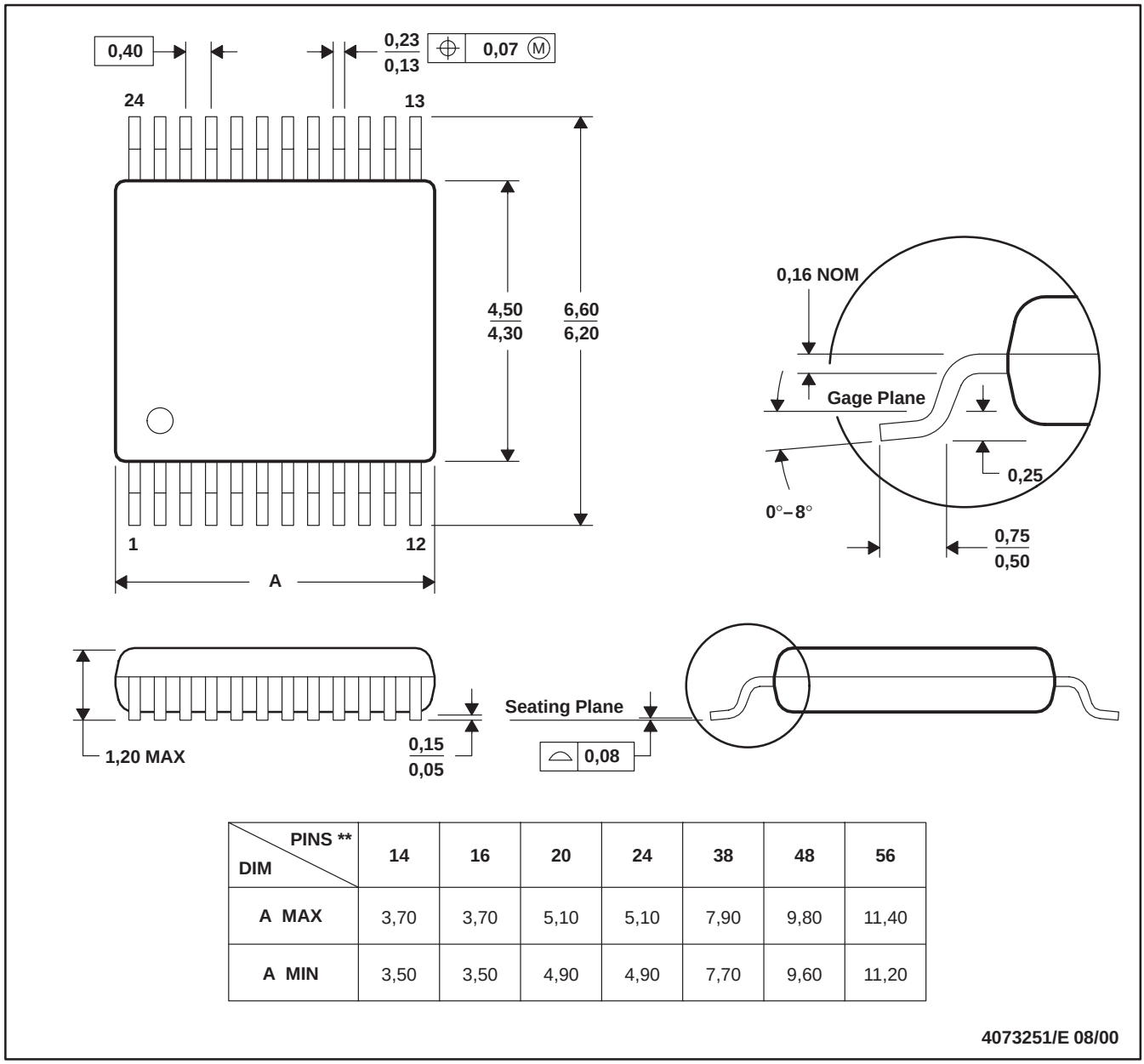


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LV240ADBR	SSOP	DB	20	2000	853.0	449.0	35.0
SN74LV240ADGVR	TVSOP	DGV	20	2000	853.0	449.0	35.0
SN74LV240ADWR	SOIC	DW	20	2000	367.0	367.0	45.0
SN74LV240ANSR	SO	NS	20	2000	367.0	367.0	45.0
SN74LV240APWR	TSSOP	PW	20	2000	853.0	449.0	35.0
SN74LV240APWR	TSSOP	PW	20	2000	364.0	364.0	27.0
SN74LV240APWRG4	TSSOP	PW	20	2000	853.0	449.0	35.0
SN74LV240APWT	TSSOP	PW	20	250	853.0	449.0	35.0

DGV (R-PDSO-G)** **PLASTIC SMALL-OUTLINE**

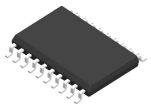
24 PINS SHOWN



DIM \ PINS **	14	16	20	24	38	48	56
A MAX	3,70	3,70	5,10	5,10	7,90	9,80	11,40
A MIN	3,50	3,50	4,90	4,90	7,70	9,60	11,20

4073251/E 08/00

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.
D. Falls within JEDEC: 24/48 Pins – MO-153
14/16/20/56 Pins – MO-194

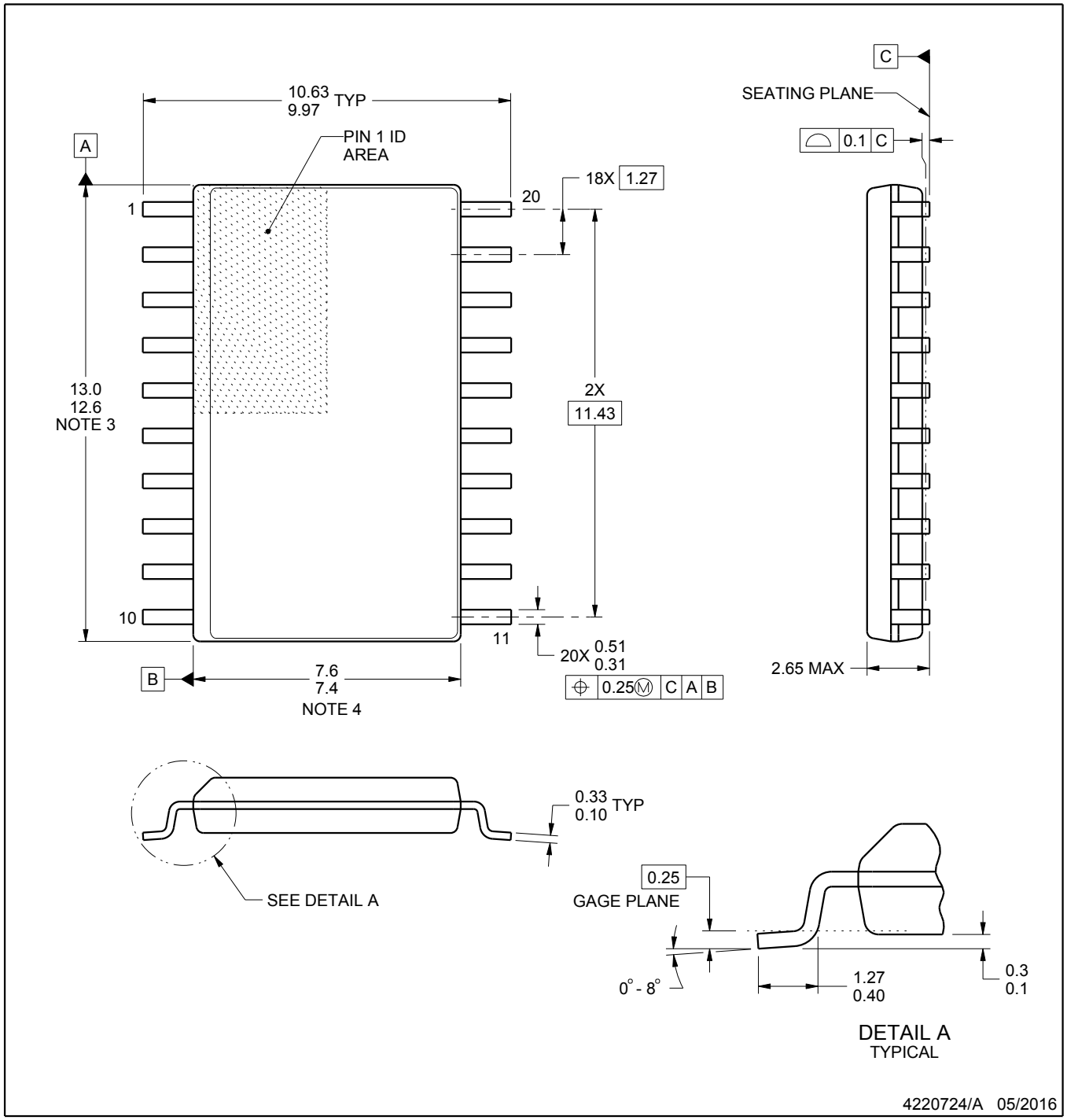


PACKAGE OUTLINE

DW0020A

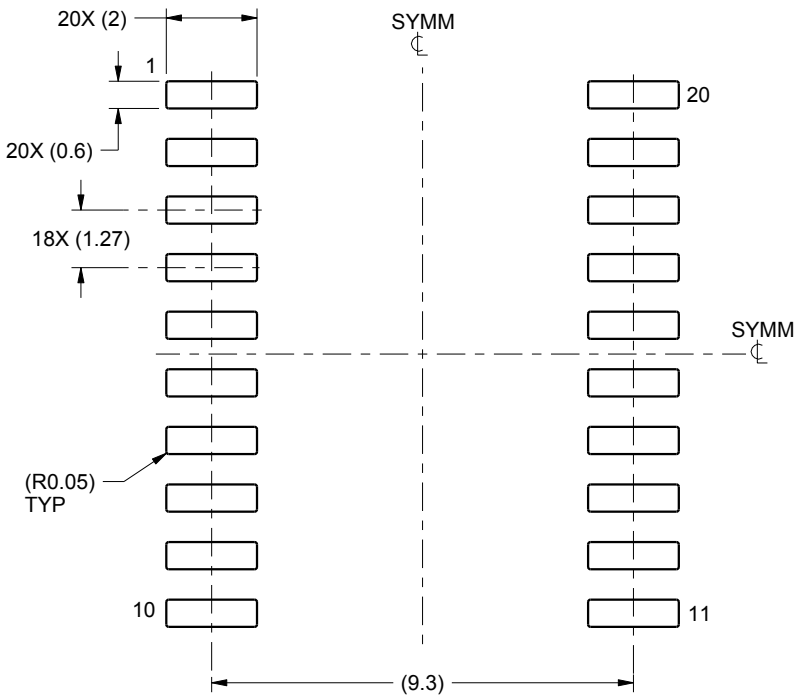
SOIC - 2.65 mm max height

SOIC

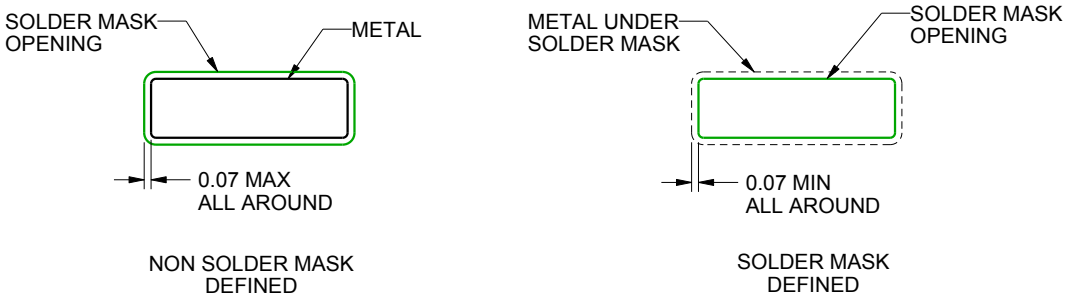


NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm per side.
5. Reference JEDEC registration MS-013.



LAND PATTERN EXAMPLE
SCALE:6X

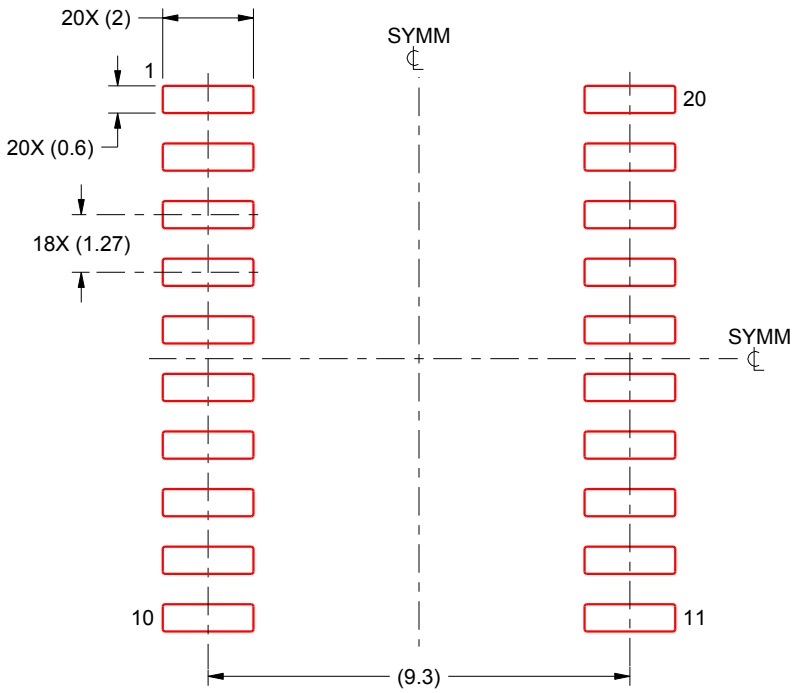


SOLDER MASK DETAILS

4220724/A 05/2016

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:6X

4220724/A 05/2016

NOTES: (continued)

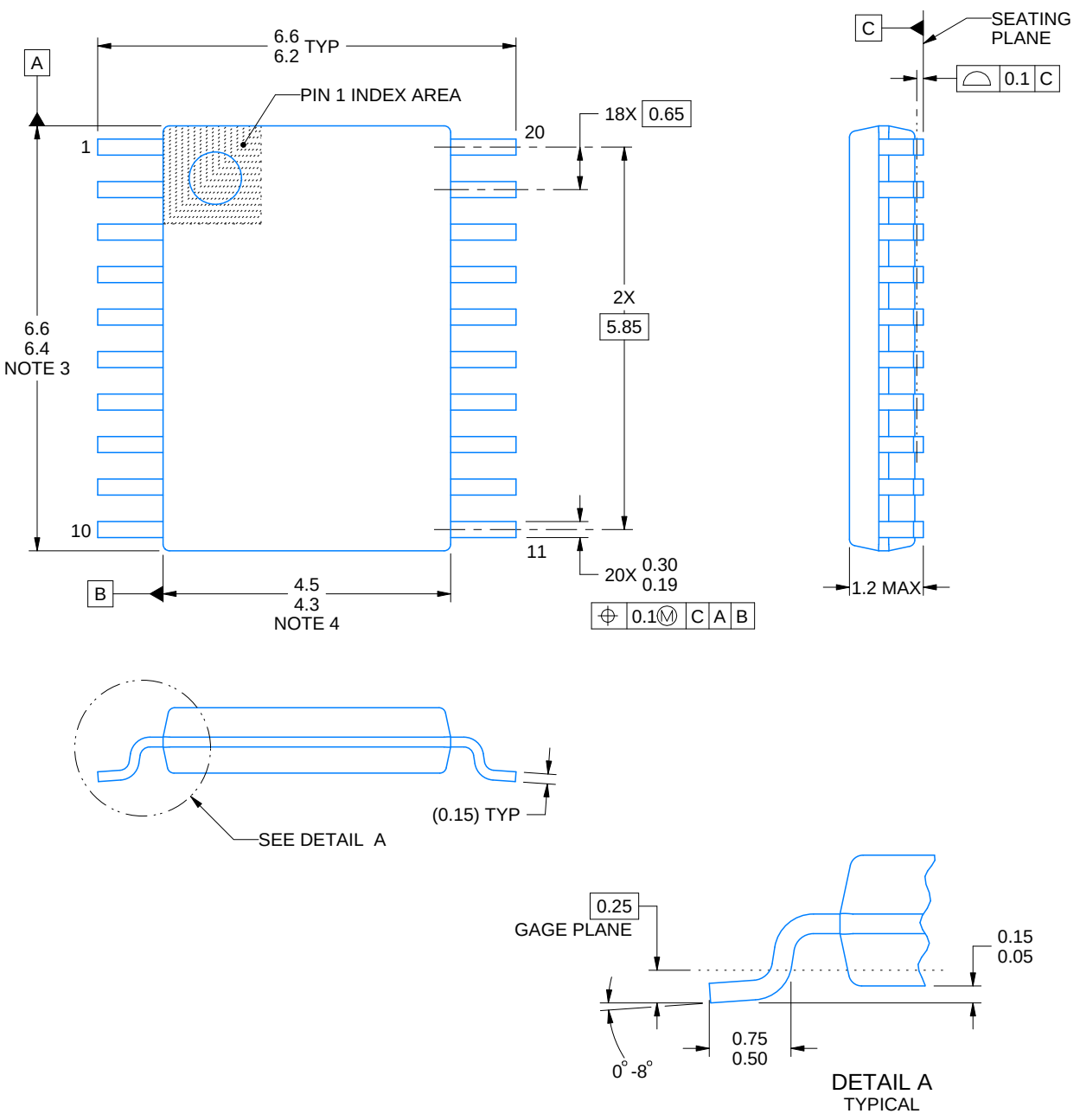
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

PACKAGE OUTLINE

PW0020A

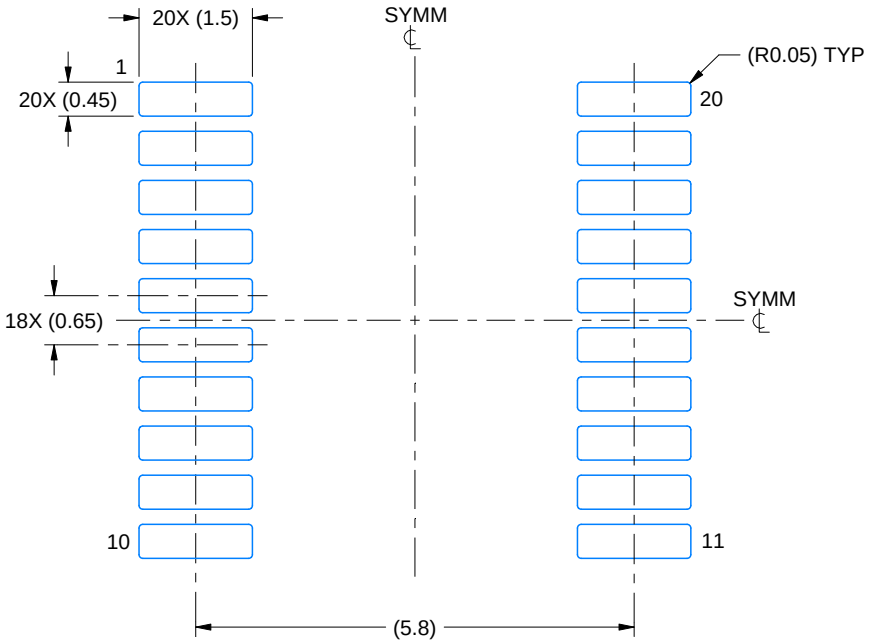
TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.



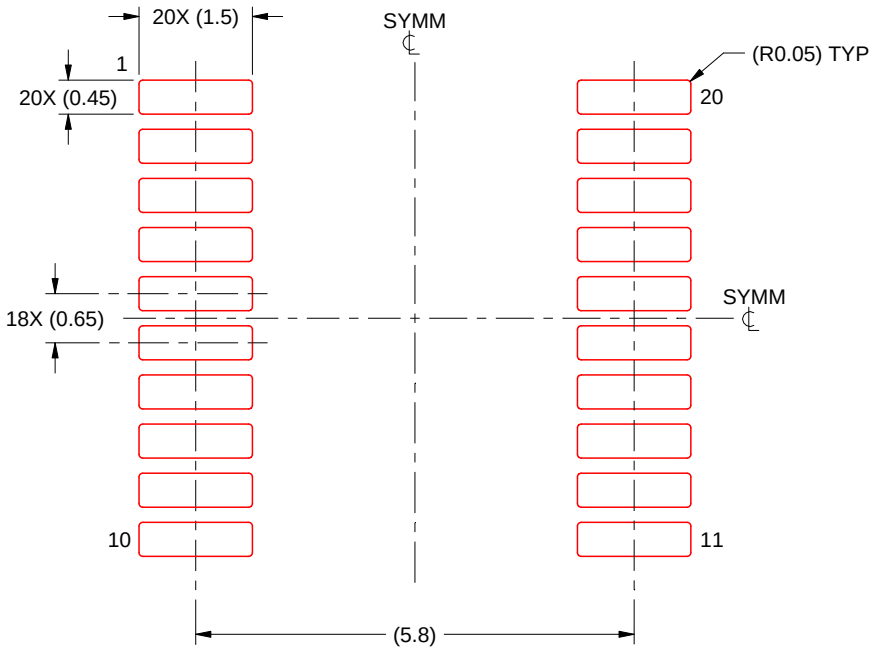
LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

SOLDER MASK DETAILS

4220206/A 02/2017

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



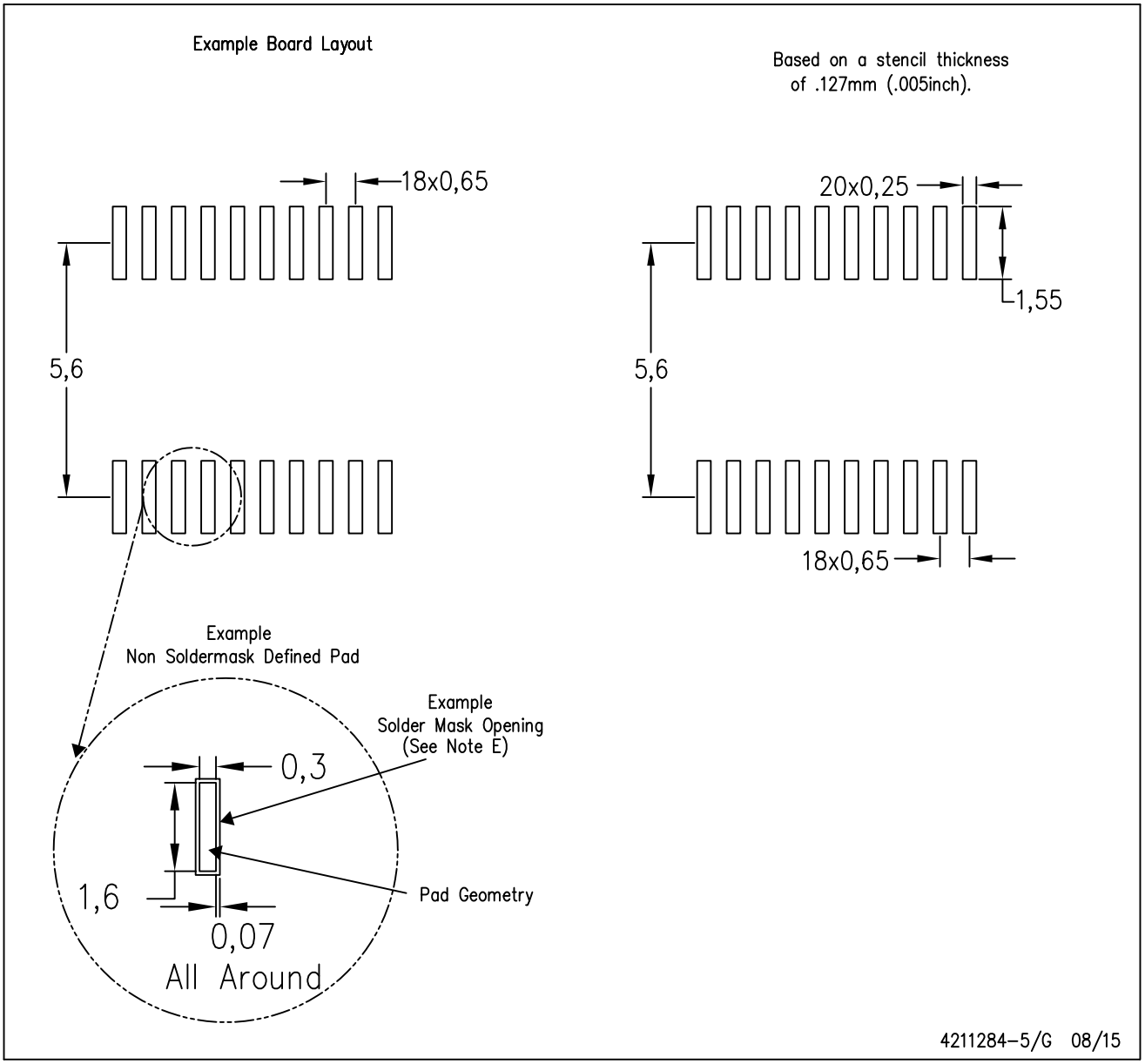
SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220206/A 02/2017

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

PW (R–PDSO–G20) PLASTIC SMALL OUTLINE



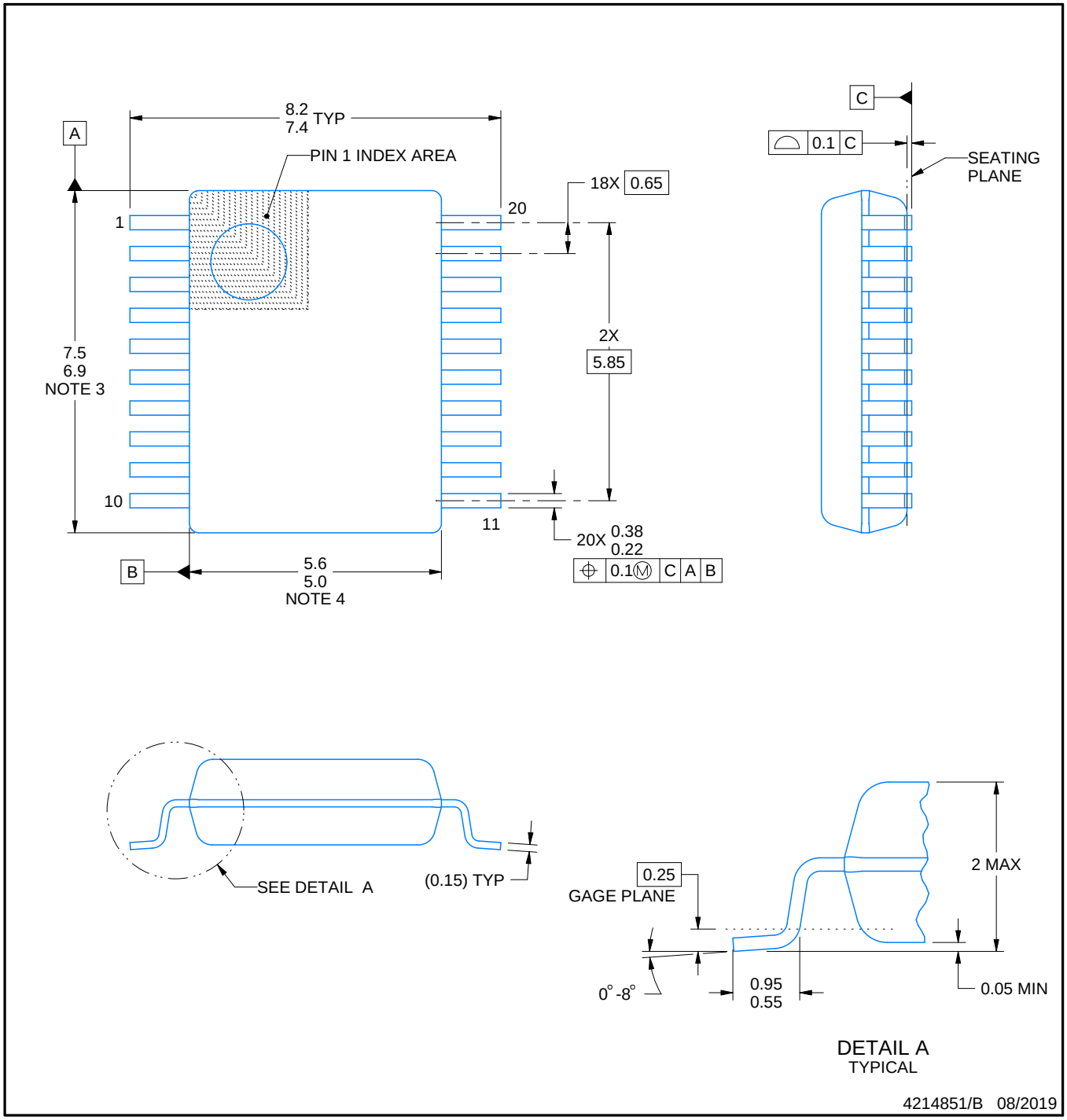
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate design.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC–7525 for other stencil recommendations.
E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PACKAGE OUTLINE

DB0020A

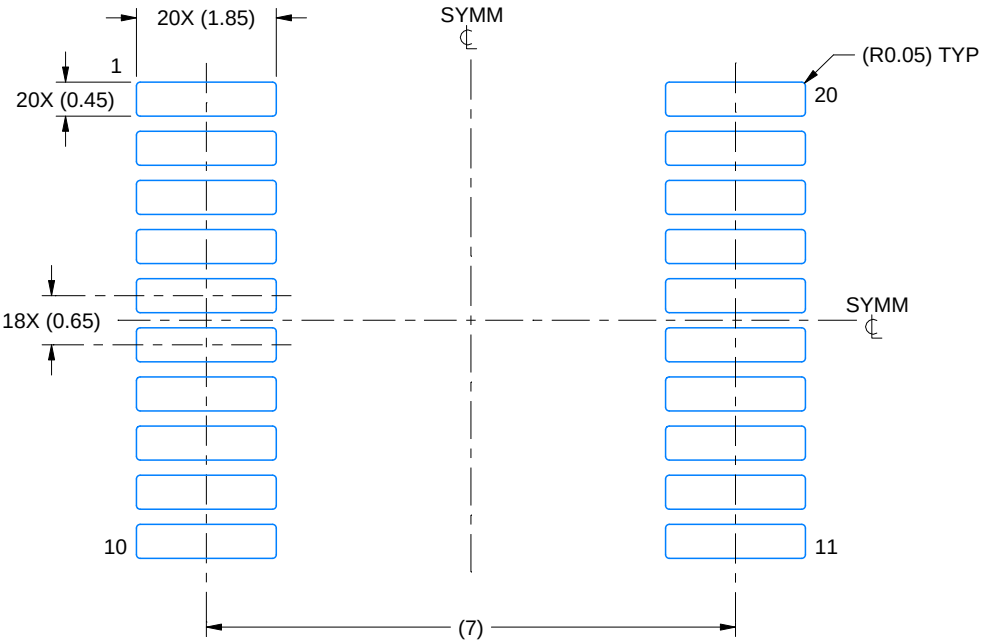
SSOP - 2 mm max height

SMALL OUTLINE PACKAGE

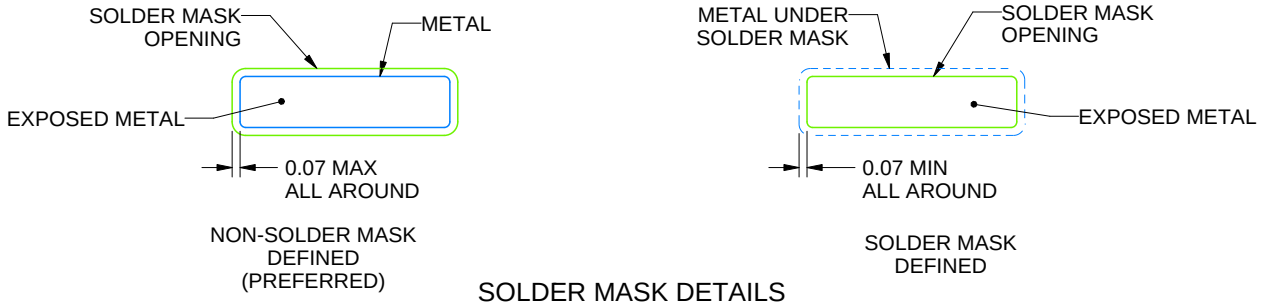


NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-150.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



SOLDER MASK DETAILS

4214851/B 08/2019

NOTES: (continued)

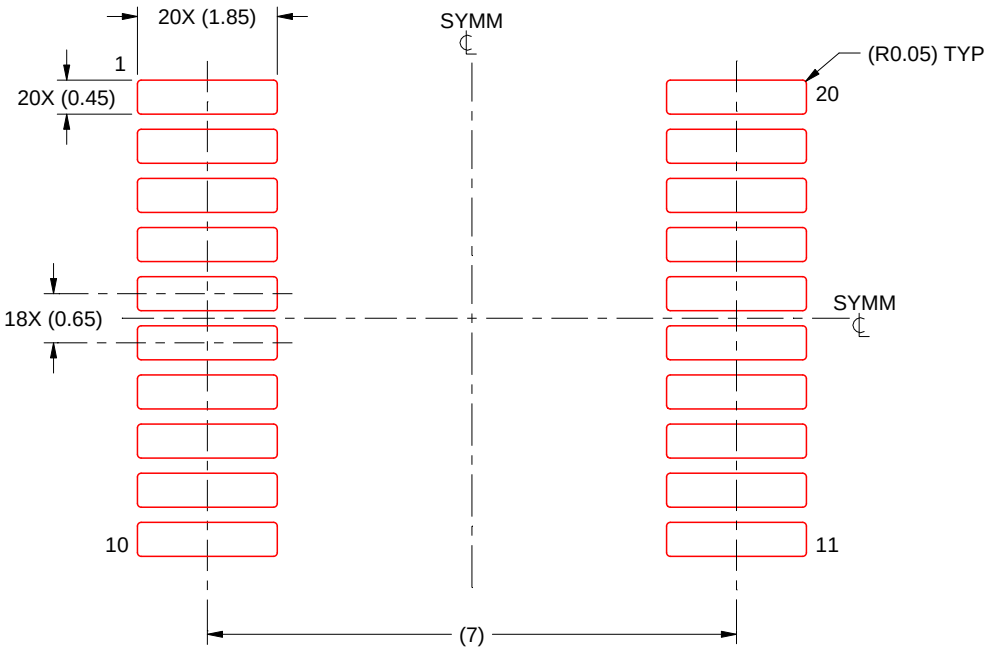
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DB0020A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4214851/B 08/2019

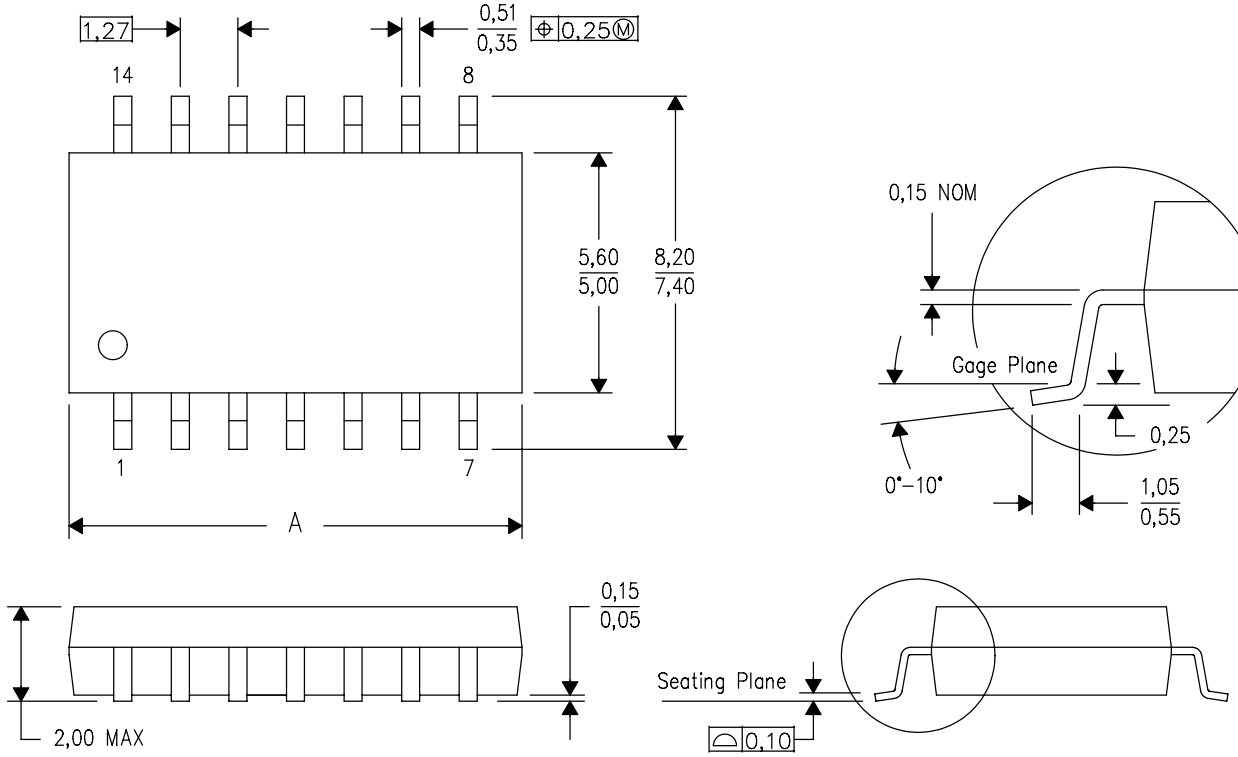
NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

MECHANICAL DATA

NS (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14-PINS SHOWN



DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

4040062/C 03/03

NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

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